



OPD 3 – CAS WEAPONS



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PURPOSE: Instruct Army Commanders and staff in the weapons used on CAS aircraft.



OVERVIEW



- ◆ Weapons Effects
- ◆ Air to Surface Guns
- ◆ General Purpose Bombs
- ◆ Precision Guided Munitions & Designation Systems
- ◆ Cluster Munitions
- ◆ Risk-Estimate Distances
- ◆ Targets / Weapons Summary



WEAPONS EFFECTS

- ◆ **Fragmentation:** Shrapnel to kill people and destroy soft targets
- ◆ **Blast:** Destroy objects through overpressure. Great for non-hardened buildings, producing concussion for crews inside tanks, and troops in the open. Bombs set to explode above the ground at a certain altitude produce a great deal of blast from the overpressure if it matches the mach wave.
- ◆ **Incendiary:** Sets things on fire.
- ◆ **Penetration:** Penetrate and destroy people/things inside hardened targets, like aircraft inside concrete hangers; troops inside a command bunker.
- ◆ **Anti-Personnel:** Good against troops in the open.
- ◆ **Anti-Armor:** Designed to penetrate the armor on tanks.



AIR TO SURFACE GUNS



◆ M61 Vulcan

- ◆ 20 mm gatling gun found on all primary fighters except the A-10
- ◆ Fires 6,000 rounds per minute
- ◆ 6 barrels

◆ GAU-8 Avenger

- ◆ 30 mm gun found on the A-10 only
- ◆ High muzzle velocity with excellent energy retention at greater distances than 20 mm
- ◆ Large ammunition capacity with rounds designed for armored vehicles
- ◆ Fires 3,900 rounds per minute
- ◆ 7 barrels
- ◆ 1174 rounds. Approximately 10 bursts



AIR TO SURFACE GUNS



◆ Guns of the AC-130:

◆ AC-130H

- ◆ One slewable 40 mm BOFORS M2A1 cannon located on the port side just aft of the wing. Fires 100 rounds per minute and can carry 256 rounds or 416 rounds
- ◆ One slewable 105 mm M102 cannon similar to the US Army Howitzer located on the port side just aft of the BOFORS 40 mm. Fires 6 - 8 rounds per minute and can carry 100 rounds. Fuses are point detonate, delay, and proximity fuses for airbursts (anti-personnel)



AIR TO SURFACE GUNS



➤ Guns of the AC-130 (Continued):

- **AC-130U** - Newest version of AC-130 with an APG-70 pulse-Doppler fire control radar for all-weather employment
 - One 25 mm GAU-12/U gatling gun located on the port side just aft of the flight deck. Fires 5000 rounds per minute and can carry up to 3000 rounds
 - One slewable 40 mm BOFORS M2A1 cannon located on the port side just aft of the wing. Fires 100 rounds per minute and can carry 256 rounds or 416 rounds
 - One slewable 105 mm M102 cannon similar to the US Army Howitzer located on the port side just aft of the BOFORS 40 mm. Fires 6 - 8 rounds per minute and can carry 100 rounds. Fuses are point detonate, delay, and proximity fuses for airbursts (anti-personnel).



GENERAL PURPOSE BOMBS



- ◆ Most common bomb; cheap, simple and versatile. In the past, GP bombs were not very accurate, but they have changed with technology
- ◆ GP bombs produce a combination of blast, fragmentation, incendiary and penetration effects
- ◆ The most common general purpose bombs are the Mark 80 series
 - ◆ MK 81, 250 lb. Bomb
 - ◆ MK 82, 500 lb. Bomb
 - ◆ MK 83, 1000 lb. Bomb
 - ◆ MK 84, 2000 lb. Bomb
- ◆ Other bombs
 - ◆ M-117, a 750 lb. bomb, is used primarily by B-52s and B-1s
 - ◆ BLU-109 or I-2000 improved 2000 lb bomb, which has a thicker case for better penetration (also available for use with precision guidance control kits).



GENERAL PURPOSE BOMBS



- ◆ GP bombs are available in 2 fin configurations, slick or high drag. High Drag or Air Inflated Retard (AIR) kits enable bombs to be dropped at lower altitudes (closer to the target) for greater accuracy
- ◆ Often configured with 2 fuses, a nose and a tail fuse, which may be cockpit selectable and may have different settings
- ◆ The typical fuse settings are: instantaneous (for fragmentation and blast), or delay (for penetration). Proximity fuses are on CBUs to set pattern size and density, and to produce frag and blast effects on GP bombs
- ◆ GP bombs can be fitted with steel nose plugs to allow for greater penetration against hardened targets. The MK 36 Destructor is a MK-82 High Drag (Snakeye) fitted with a MK 75 arming kit which converts the bomb into a land or water mine for area denial purposes.
- ◆ The BLU-82 is a 15,000 lb GP bomb dropped by C-130s. It produces a lot of blast and can clear helicopter landing zones



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ **Maverick (AGM-65)**

- ◆ A 500 lb. class rocket-propelled munition compatible with F-16, A-10, F-15E, F-4G and Navy/Marine attack aircraft
- ◆ The A, B, and D models have a 125 lb. shaped charge warhead
- ◆ The E, F, and G models have a 300 lb. fragmentation warhead
- ◆ The A&B models (TV) are not effective at night.
- ◆ The D, F, & G (IR) models have day/night good weather capability
- ◆ The E model (Laser) is used by the Navy and Marine Corps and has day/night good weather capability (Require designator)
- ◆ The K Model is a retrofit of the A and B model with a bigger warhead and improved TV camera (In development)
- ◆ Standoff launch and leave capability



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ Laser Guided Bombs (LGB)

- ◆ Laser guidance kits attached to:
 - ◆ MK-82 becomes GBU-12
 - ◆ MK-84/BLU-109 becomes GBU-10
 - ◆ MK-84/BLU-109 becomes GBU-24 (low level LGB)
 - ◆ BLU-113B (4500 lb.) becomes GBU-28
- ◆ Provide pinpoint accuracy for "point" or "single" targets
- ◆ Good day or night (Can't guide LGBs through clouds)
- ◆ The LGB's effect is the same as the bomb guidance kit
- ◆ Range of an LGB is generally 3 miles (low altitude) and 5 miles (medium altitude) (Dependant on A/C speed, altitude, and angle)



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ Pave Penny Pod

- ◆ Laser acquisition only device on the A-10
- ◆ Enables the pilot to acquire a laser spot on the ground designated by a ground or an airborne platform



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



- ◆ **LANTIRN** (Low Altitude Navigation and Targeting Infrared for Night)
 - ◆ Consists of two externally mounted pods
 - ◆ Navigation pod
 - ◆ Targeting pod
 - ◆ The Navigation pod provides day or night low altitude operation using Forward Looking Infrared (FLIR) and Terrain Following Radar (TFR).
 - ◆ FLIR provides unique capabilities for passive navigation and target detection
 - ◆ TFR allows for low altitude navigation and terrain avoidance below cloud decks
 - ◆ The Targeting pod allows around-the-clock, beneath cloud, delivery of both conventional and precision guided weapons using laser ranging and designation
 - ◆ Built for the F-16 and F-15E.



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ **Data Link Weapons:** Data link weapons are bombs with either a TV or infrared (IR) camera that provides feedback to the guider

◆ **GBU-15**

- ◆ A precision guided standoff weapon.
- ◆ Consists of a modular bomb kit attached to a MK-84 or BLU-109 (BLU-109 is a MK-84 with an Improved Penetrator Body)
- ◆ TV version is day, good weather only
- ◆ IR version is day or night (requires good weather, and unusable at thermal crossover)
- ◆ Compatible with the F-15E
- ◆ The E-GBU-15 is the same as the GBU-15 with GPS/INS kit



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ Data Link Weapons:

◆ AGM-130

- ◆ Rocket assisted version of the GBU-15 with increased range and stand-off attack capability against high value targets
- ◆ Can be attached to either a MK-84 or BLU-109, and either a TV or IR camera

◆ AGM-142

- ◆ Data link standoff missile on the B-52 only. It has either an IR or EO camera with either a 750 or 775 lb warhead.
- ◆ GPS/INS aided munitions
- ◆ Target coordinates entered into the bomb prior to T/O (some A/C)
- ◆ Designed to go against stationary point targets



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ Data Link Weapons:

◆ **AGM-86** - Conventional Air Launched Cruise Missile

- ◆ Launched from a B-52
- ◆ 3000lb warhead designed to produce blast effects

◆ **JDAM, GBU-31, 32** - Joint Direct Attack Munition

- ◆ INS/GPS guidance kit added to MK-83, 84, or BLU-109
- ◆ Receives position/targeting updates from the A/C prior to release
- ◆ Each bomb can have different target coordinates (multiple targets hit from a single pass)
 - ◆ MK-83 with JDAM becomes GBU-31
 - ◆ MK-84 with JDAM becomes GBU-32
- ◆ JDAM is operational on the B-2, B-1, B-52, and certain blocks of the F-16
- ◆ JDAM range is slightly more than that of Laser Guided Bombs.



PRECISION GUIDED MUNITIONS & DESIGNATION SYSTEMS



◆ Data Link Weapons:

◆ AGM-154 (JSOW) - Joint Standoff Weapon

- ◆ Thin bomb body with wings, fins, and a GPS/INS guidance kit
- ◆ Bomb does not have a motor, but its aerodynamic qualities give it an extended range of more than 25 Nautical Miles
- ◆ The effects of the JSOW is determined by the sub-munitions contained in the bomb body
- ◆ JSOW can carry either the sub-munitions found in the CBU-87, or CBU-97, or a 500lb penetrator



CLUSTER MUNITIONS



◆ CBU-52, CBU-58, CBU-71 (Out of AF Inventory)

- ◆ NATO/Coalition countries may still use these weapons
- ◆ The dud rate on CBU 52/58/71 is high (EOD is a problem)
- ◆ CBU = SUU (Suspension Unit) + BLU (Bomb Live Unit or bomblets)
- ◆ CBU-52 = SUU-30 + 220 softball size BLU-61 (Anti-personnel and material)
- ◆ CBU-58 = SUU-30 + 650 baseball size BLU-63 (Anti-personnel and material)
- ◆ CBU-71 = SUU-30 + 650 baseball size BLU-86 (Random delayed detonation for area denial)
 - ◆ BLU-61/63 are spin armed and detonate on impact
 - ◆ BLU-86 bomblets are similar to BLU-63 and have a mix of instantaneous and random time delays for detonation
 - ◆ BLU-61/63/86 are primarily fragmentation weapons with some incendiary capability (Excellent against soft or thin-skinned targets)



CLUSTER MUNITIONS



◆ **Rockeye (MK-20 Out of AF Inventory)**

- ◆ British still use a BL-755 weapons very similar to the MK-20
- ◆ Cluster munitions effective against armor as well as personnel
- ◆ Consists of 247 bomblets in a MK 7 dispenser
- ◆ Bomblet has primarily an anti-armor function but does produce some fragmentation

◆ **CEM, CBU-87 - Combined Effects Munitions**

- ◆ Cluster munitions designed to replace the Rockeye and CBU-58.
- ◆ Called Combined Effects Munitions (improved effects in incendiary, fragmentation, and armor piercing capabilities)
- ◆ Has 202 sub-munitions in a tactical munitions dispenser (TMD)



CLUSTER MUNITIONS



◆ CBU-89 - Gator Munitions System

- ◆ Cluster munitions consisting of a combination of anti-armor and antipersonnel mines delivered in a TMD
- ◆ Similar to artillery Family of Scatterable Mines (FASCAM).
- ◆ Arming initiated upon release
- ◆ Mines are equipped with self-destruct timers (Number Classified)

◆ CBU-97 - Sensor Fused Weapon SFW

- ◆ Smart sub-munitions incorporated into a cluster weapon
- ◆ Designed to defeat armored targets from above using IR sensors
- ◆ Consists of 10 BLU-108/B sub-munitions, with 4 anti-armor warheads (skeets) each (disperses its skeets sequentially in an "X" pattern, with its IR sensors spinning and scanning a large elliptical area over the targets)
- ◆ A single skeet covers a search area of approximately 100 x 300 feet
- ◆ CBU-97 scan pattern will describe a search pattern 1200' X 700'
- ◆ If no target is found, fires after 8 seconds



CLUSTER MUNITIONS



- ◆ **WCMD, CBU-103, 104, 105** - Wind Corrected Munitions Dispenser
 - ◆ WCMD is an inertial guidance kit added to the tail of the CBU-87, 89, and 97.
 - ◆ CBU-87 becomes CBU-103
 - ◆ CBU-89 becomes CBU-104
 - ◆ CBU-97 becomes CBU-105
 - ◆ WCMD corrects errors by receiving positional and targeting updates from the aircraft before release
 - ◆ IOC for fighters and bombers is scheduled for 2001 and beyond
 - ◆ The effects of WCMD is the same as the CBU the WCMD kit is attached to



RISK-ESTIMATE DISTANCES



- ◆ **Risk-estimate distances are based on the following assumptions**
 - ◆ **Computations:** All attacks are parallel to the FLOT. Distances are computed from the intended impact point of the center of a stick of bombs. **Risk-estimate distances are for combat use and are not minimum safe distances for peacetime training use.** Peacetime minimum numbers can be found in ACCR 55-26
 - ◆ **Relationships Between Weapon Impact And Point Of Intersection:** Prone man on a line perpendicular to the line of flight.



RISK-ESTIMATE DISTANCES



◆ Casualty Criterion

- ◆ The casualty criterion is the 5-minute assault criterion for a prone soldier in winter clothing and helmet. The probability of incapacitation (PI) means a soldier is physically unable to function in an assault within a 5-minute period after an attack. The 0.1 percent PI value can be interpreted as being less than or equal to one chance in a thousand.

◆ Troops In Contact

- ◆ Friendlies within 1 kilometer of target
- ◆ The ground commander must accept responsibility for friendly risk when targets are inside 0.1 percent PI
- ◆ The passing of the ground commander's initials indicates his acceptance of the risk.



TARGETS / WEAPONS SUMMARY



Targets	Weapons
Armor	AGM-65 Maverick, 30 mm (GAU-8), 40 mm/105 mm (Gunship), CBU-87, 103 CEM, CBU-89, 104 Gator Mines, CBU-97, 105 SFW
Area Denial & channelization	CBU-89, 104 Gator Mines, CBU-71 (Random fusing BLU-86 bomblets), MK-36 Destructor on MK-82 Snakeye
“Soft” Targets	GP Bombs, CBU-52/58/71, CBU-87, 103 CEM, 20 mm/30 mm (API/HEI), 25 mm/40 mm/105 mm (Gunship)
Point Targets	LGBs (GBU-10,-12,-14,-24,-28,-31,-32), AGM-65 Maverick GBU-15/AGM-130, 20 mm/25 mm/30 mm/40 mm Guns, AC-130 105 mm cannon
Hardened Targets	GP bombs with steel nose plugs, BLU-109, LGBs (GBU-10,-12,-14,-24,-28,-31,-32), AGM-65 Maverick, GBU-15/AGM-130, 105 mm Howitzer (Gunship)



REVIEW



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QUESTIONS

